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## (54) IMPROVEMENTS IN OR RELATING TO A VARIABLE PRESSURE INSERT MATTRESS

(71) I, THOMAS SEWELL HARGEST, a citizen of the United States of America, residing at 1078 Winslow Drive, Charleston, South Carolina 29412, U.S.A., do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to mattresses and more particularly to a mattress with a cavity therein, into which an insert may be placed.

Many paraplegics, quadraplegics, burned victims, older persons, and persons that have been ill for a long period of time have a tendency to lie very still in bed. These persons have a tendency to develop decubitus ulcers or bed sores due to lack of proper support. This problem has been recognized medically and to combat the problem, devices, such as air fluidized beds, mud beds, and water beds, have been developed. These devices all have inherently bad features. For example, all are very expensive, all are very heavy, and none are easily adaptable for hospital use for all types of patients.

According to this invention there is provided a mattress comprising two support surfaces, a cavity within one of said two support surfaces and an insert to fit said cavity, characterized in that said insert is reversible having a first side and a second side with different support capabilities.

Preferably said first side of said insert has a support quality similar to the mattress while said second side of said insert comprises an array of individual support elements, each with a support capability independent of that of the others, thereby permitting a patient's body to sink into said mattress until each element has picked up its proportional part of the body weight.

Such a mattress may be utilized in a hospital in the same manner as any standard mattress. The insert, placed within the mattress cavity with its first side ex-

posed, may produce the same inherent qualities of an ordinary mattress. When a patient for whom decubitus ulcers or bed sores may be a problem, uses the mattress, the insert may be reversed so that its second side is exposed and the patient will have proper support by the individual elements of the insert by use of a plurality of the individual support elements for the area of the person that is on the insert. Different inserts may be used for patients of varying weights. The inserts may be disposable and inexpensive. The present invention can enable a hospital to use a single mattress for patients with differing mattress support requirements.

The entire insert may be made from a portion of foam product. The insert may be formed from materials of varying densities, thereby being capable of support for persons of varying weights. The mattress may comprise a plurality of cavities and a plurality of inserts to provide differing support capabilities in differing positions in the mattress. The mattress may also be made from a portion of foam product.

As stated the first side of the insert preferably has support qualities similar to the sides (i.e. support surfaces) of the mattress, and its second side comprises a plurality of individual support elements each with an independent support capability. When the insert is placed within the cavity, persons may lie on the first side and the mattress acts as an ordinary mattress, providing uniform support capability. When the insert is placed within the cavity so that persons may lie on the second side, the mattress supports the area of the person that is on the insert by a plurality of individual support elements. It is desirable that surrounding the plurality of individual support elements is a plurality of openings, whereby when any of the plurality of individual support elements is providing support, each of the plurality of openings is still capable of ventilation. The plurality of individual support elements may be formed from varying densities of material.

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As stated the insert may be made from a portion of foam product. The plurality of individual support elements may be formed by cutting a plurality of pieces of foam product from a first section of the portion of foam product. The areas from which the pieces of foam product are taken then form a plurality of openings which are capable of ventilation. The base for the plurality of individual support elements may be the second section of foam product or the section of foam product from which the plurality of pieces of foam product are not cut. The foam product may be cut at an angle which is deemed proper to provide the desired support.

Embodiments of the invention will be described in detail with reference to the accompanying drawings in which:  
 Figure 1 is an exploded isometric view showing a mattress and insert.

Figure 2 is a top view of the mattress and the insert with the insert side with a plurality of individual support elements facing upward.

Figure 3 is a section view taken at points A-A of Figure 2.

Figure 4 is a top view of the mattress and the insert with the side of the insert with the plurality of individual support elements facing downward.

Figure 5 is a section view taken at points B-B of Figure 4.

Figure 6 is a top view of a mattress showing two cavities in the mattress.

Referring now to the drawings, Figure 1 is an exploded isometric view showing the mattress and the insert. Mattress 1 is an ordinary mattress in which a cavity 4 has been cut. As in an ordinary mattress, persons may lie on either of two sides of the mattress. Persons may lie on first surface 2 of mattress 1 or second surface 3 of mattress 1. Insert 5 has been designed to fit into cavity 4 of mattress 1. Insert 5 is basically a rectangular insert which may be placed into cavity 4 in two positions. Insert 5 may have first side 10 or second side 11 facing upward out from the mattress surface 2. First side 10 has support quality similar to mattress surface 2. Second side 11 comprises an array of individual support elements, such as individual support elements 12, 13, 14, 19, 20, 21, 22, and many other support elements shown in Figure 1 and not numbered. In the embodiment shown the elements are of frusto-pyramidal shape, with substantially square cross section. Each individual support element has an independent support capability, so that when insert 5 is placed within cavity 4 so that a person may lie on second side 11, the person or the person's body lying on insert 5 will be supported by the plurality of individual support elements. If insert 5

is inserted into cavity 4 so that first side 10 is up, the mattress acts as an ordinary mattress and gives ordinary support to the person. If the insert 5 is placed within cavity 4 so that the plurality of individual support elements faces in and first side 10 faces outward, the mattress may be turned over and used as an ordinary mattress.

The insert may be made from a portion of foam product. If so, the array of individual support elements may be formed by cutting a plurality of pieces of foam product, such as pieces 27 and 28 from a first section 25 or top of the portion of foam product. The pieces are cut out along a network of intersecting orthogonal lines, as shown. The removal of the plurality of pieces of foam product, such as pieces 27 and 28, create voids or openings, such as openings 29 and 30 in second side 11, of insert 5. The plurality of openings is designed so that each of said plurality of individual support elements has independent support capability, and each of said plurality of openings is capable of ventilation. For example, after said plurality of pieces of foam product are cut from insert 5, openings or voids are created, such as opening 23 between elements 12 and 13, opening 24 between elements 13 and 14, opening 16 between elements 19 and 20, opening 17 between elements 20 and 21, and opening 18 between elements 21 and 22.

A base 15 is provided for the plurality of individual support elements. Base 15 is of sufficient depth to maintain the independent support capability of each of the plurality of individual support elements. When the insert is made from a portion of foam product, and the individual support elements are formed by cutting a plurality of pieces of foam product from a first section 25 of the portion of foam product, the base is formed from a second section 26 of the portion of foam product from which the plurality of pieces of foam product are not cut.

Figure 2 shows a top view of the mattress 1 and insert 5 with the plurality of individual support elements facing upward. This is the position where use of the mattress is for the paraplegics, quadriplegics, burned victims, older persons, and persons that have been ill for a long period of time and have a tendency to lie very still in bed. These persons have a tendency to develop decubitus ulcers or bed sores due to lack of proper support. The plurality of individual support elements facing upward on second side 11 of insert 5 decreases the pressure on localized areas of the body by increasing the area of support. The present invention increases the number of supporting points by decreasing the inte-

grity of the surface of the mattress 1 by providing individual supporting pads, viz. the plurality of individual support elements, which are independent of one another. For hospital use, it may be impractical to cover second side 11 of insert 5, when the insert is used for the bedridden patients. When not covered, the insert is susceptible to contamination. This problem can be overcome by having inserts which may be disposed of and replaced by other inserts if the insert 5 should become contaminated. The inserts as described are easily made and are relatively inexpensive.

Figure 3 is a section view taken at point A-A of Figure 2. Figure 3 shows first surface 2 and second surface 3 of mattress 1. The insert 5 is placed within the cavity 4 of mattress 1. In Figure 3, the second side 11 with the plurality of individual support elements is shown facing up and first side 10 is shown facing down in the cavity.

Figure 4 is a top view of mattress 1 and insert 5 shown with first side 10 of insert 5 upward, and second side 11 of insert 5 facing downward into the mattress 1. With the insert in this position, the mattress may be used as an ordinary mattress, and if reversed and used by persons lying on second surface 3 of mattress 1, mattress 1 will act and feel as an ordinary mattress giving ordinarily proper support.

Figure 5 is a section view taken at point B-B of Figure 4. In Figure 5, it may be seen that second side 11 with the individual support elements facing down into the mattress and first side 10 with support quality similar to the sides of the mattress 1 facing upward.

Figure 6 shows mattress 6 with mattress surface 7. In mattress surface 7 is shown both cavity 8 and cavity 9. Figure 6 illustrates that in some cases it may be advantageous to provide different amounts of support for differing portions of the body: by having cavities 8 and 9 in various portions of the mattress 6 and by placing different inserts into said mattress, differing qualities of support can be obtained. Inserts can be provided to raise or lower portions of the body with respect to the rest of the body on the mattress and also to provide differing support levels as desired. Mattresses may be custom designed and made to provide any particular support requirements for any desired treatment for any particular situation.

Cavity 4 consists of a bottom portion and side portions within which insert 5 may fit. The mattress may be constructed in various manners and the inserts can be constructed in several ways. One way to manufacture this invention would be to provide three

separate pieces of foam product. A five inch thick slab of foam product may be used for the major portion of the mattress. A section of the five-inch slab is cut to provide the cavity. The cut section may be eighteen inches wide and thirty-six inches long or any other desired dimensions. If the five-inch slab of foam product is cut completely through to form the cavity, then another slab of foam product, possibly a two-inch thick slab, may be glued to the five-inch slab to form the major portion of the mattress. The two-inch piece will thus form a base which will strengthen the five-inch slab. It would probably not be desirable to have a cavity in the mattress which extended all the way through to both sides of the mattress. If the insert is made of foam product, a five-inch thick piece of foam product may be used to fit into the five-inch deep cavity of the mattress. The foam product may be cut to create a plurality of individual support elements. The foam product may be cut so that a plurality of two-inch squares of foam product, with a one-inch space in between, lies in one side of the insert. A depth of about one and one-half to two inches is uncut forming the base of the insert and providing support for the individual support elements, so that the individual support elements will each have independent support capability.

The inserts may be made from variable densities of foam. A lighter density or a piece of foam product that is less firm may be used for lighter people, a medium density of foam product may be used for average people, and a high density of foam product for heavier people. The exact size or depth or shape or design of the insert is entirely up to the designer and this invention covers and anticipates all sizes, shapes and methods of manufacture of any mattress containing a cavity within which an insert may be placed.

In the insert, second side 11 has the plurality of individual support elements. When the insert is made of foam product, the integrity of the foam product is destroyed by the cutting of plurality of the pieces of foam product from the first section 25 of the portion of foam product. This is desirable for it lets the body lying on the insert gently sink into the foam until the pressure is picked up by various portions of the body instead of just certain portions as in the ordinary mattress. The insert would then provide support with not as much pressure in given points, but all of the pressure distributed better over the total surface of the body. This method reduces capillary pressure on certain portions of the body, and inhibits the development of pressure sores.

This mattress is unique in that the mattress may be utilized as a particular type of mattress for a particular type of patient, such as the patient who has bed sores or might develop bed sores. Yet, it also may be used as a standard mattress for any other hospital patient. In the hospital, if the insert becomes contaminated, it may be disposed of and replaced. Different inserts formed from materials of varying densities may be used to provide support for persons of varying weights. The openings or valleys between the individual support elements allow ventilation and air circulation which will act to prevent perspiration by the patient.

The portion of the body lying on the individual support elements has the pressure of the body distributed over a much larger area. Each portion of the body can be pressed down far enough so that it relieves the pressure being placed upon it. The support is being given by each individual support element and no support is received from the element on either side of each element. The pressure on each portion of the body is relieved so that there is not too much pressure which tends to shut off the capillary blood flow to the skin, and thereby causes decubitus ulcers or bed sores.

Any type of insert may be used which can comprise a plurality of individual support elements. The plurality of individual support elements may have a base to aid in the independent support capability of each of the plurality of individual support elements. Any materials may be used to form the plurality of individuals support elements.

As stated, the plurality of individual support elements of the invention may be made from a foam product by cutting same. A foam product may comprise any product of flexible foam, polyurethane, foam rubber, and any other comparable product.

In an ordinary mattress, the integrity of the surface is paramount to its ability to support the occupant. The cover of the mattress itself tends to have an effect like a hammock on the occupant. This problem is solved by destroying the integrity of the surface, by removing the cover, and cutting the surface of the foam product, thereby rendering each supporting element independent of the others, permitting the occupant's body to sink into the mattress until each element has picked up its proportional part of the body weight.

This method of support is not like a spring. A spring when compressed gains in force. Flexible foams do not gain force when compressed. The edges of a coil spring are stronger than its center, as com-

pared to the elements of foam product in which the edges are the weakest.

The mattresses described above are easily adaptable for hospital use for many types of patients, and can provide an inexpensive mattress for use by a patient for whom decubitus ulcers or bed sores may be a problem. They can also provide a relatively light mattress, easily adaptable for hospital use, for many types of patients.

While the invention has been described with reference to specific embodiments, the description is illustrative and is not to be construed as limiting the scope of the invention.

#### WHAT I CLAIM IS:—

1. A mattress comprising two support surfaces, a cavity within one of said two support surfaces and an insert to fit said cavity, characterized in that said insert is reversible, having a first side and a second side with different support capabilities.

2. A mattress according to claim 1, characterized in that said first side of said insert has a support quality similar to the mattress and in that said second side of said insert comprises an array of individual support elements, each with a support capability independent of that of the others, thereby permitting a patient's body to sink into said mattress until each element has picked up its proportional part of the body weight.

3. A mattress according to claim 2, characterized in that said support elements have a substantially frusto-pyramidal shape and are obtained by cutting along a network of intersecting lines.

4. A mattress according to claim 3, characterized in that said cutting network is a network of orthogonal lines, the cross section of each of said frusto-pyramidal elements being substantially square.

5. A mattress according to claim 4, characterized in that said cutting network provides a plurality of openings separating each of said array of individual support elements, whereby when any of said array of said individual support elements is providing support, each of said plurality of openings is still capable of ventilation.

6. A mattress according to any one of claims 2 to 5 characterized in that said array of individual support elements is formed from varying densities of material, thereby being capable of support for persons of varying weights.

7. A mattress according to any one of claims 2 to 6 characterized in that said insert includes a base for said network of individual support elements, said base being of sufficient depth to maintain said independent support capability of each of said network of individual support elements.

8. A mattress according to any one of the preceding claims, characterized in that said insert is made from a portion of foam product.

5 9. A mattress according to claim 8 as appendant to claim 7, characterized in that said base is formed from a second section of said portion of foam product, said  
10 second section having no array of individual support elements cut therein.

15 10. A mattress according to any one of the preceding claims, characterized in that said insert is disposable and can be replaced by other inserts if said insert should become contaminated.

11. A mattress according to any one of the preceding claims, characterized in that said mattress comprises a plurality of cavities and a plurality of inserts to provide differing support capabilities at differing  
20 positions in said mattress.

12. A mattress substantially as described herein with reference to and as illustrated in the accompanying drawings.

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COMPLETE SPECIFICATION

2 SHEETS

This drawing is a reproduction of  
the Original on a reduced scale.  
SHEET 1

**Fig. 1.**



